ATTACHMENT 2.2

EXECUTIVE SUMMARY FORM

Next-generation Power Management User Interface for Office Equipment

Focus: End-Use Efficiency; Commercial Buildings

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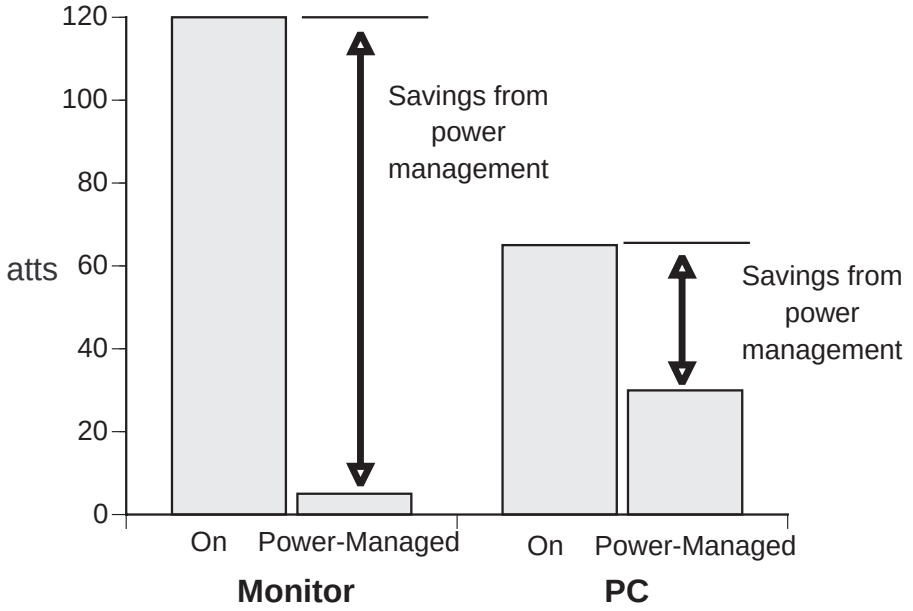
Executive Summary

Electricity savings from power management of office equipment has been one of energy efficiency's premier success stories. The problem of large amounts of energy being used by office equipment was noted only in the late 1980s. Less than five years later the efficiency opportunity of power management had been recognized, technically described, and implemented through the EPA ENERGY STAR program, resulting in commercially available products available for sale and in use by consumers. ENERGY STAR has garnered the majority of many categories of office equipment sales, each year saving many TWh of electricity and consumers over a billion dollars.

Despite this success, many devices that are *capable* of power management are not saving energy because the power management features are disabled, incorrectly configured, or thwarted by a hardware or software conflicts. For PCs, the great majority are *not* power-managing, with enabling rates as low as 15%. Thus, for PCs and other office equipment, there is the potential for considerable additional savings through higher enabling rates in power management. The goal of this project is to capture the energy savings by increasing the rate at which power management is enabled and operates successfully. The research aspect is discovering the characteristics and elements of an optimal standard user interface. Nearly all commercial electricity customers in the state (and many residential and industrial customers as well) will benefit from these savings.



The figure above demonstrates the magnitude of energy savings when power management is enabled. On the great majority of PCs, and on office equipment generally, power management is not *enabled and so these savings are lost.*

Power management controls in office equipment show little consistency in the terms and symbols used and in their overall structure. This is particularly true across device types (e.g. between a PC and a copier), but often holds even within the same type of device. For example, 'standby' mode on some copiers refers to the state when they are immediately ready to act, but 'standby' mode on monitors refers to a low-power mode in which they are not fully active. Ordinary users simply give up when confronted with the confusion and ambiguity of so many power management controls. A second deterrent is that users cannot easily ascertain the power status of office equipment, so they don't know when they should enable them. The combination of *controls* and *indications* of power status is the *user interface*.

The research aspect of this project is the development of more effective and standardized user interfaces. Since these interfaces will be consistent across many types of devices, they will also become familiar to office workers and thus additionally easier to use. The standard will be voluntary—no company will be required to use it—and can be adhered to entirely or only partially by manufacturers. This allows gaining the benefits of a standard while retaining flexibility for manufacturers that believe that they can improve on the interface, or have a product with unique or unanticipated features.

The need to improve enabling rates (with a standard interface) will only increase in the coming years, as power management appears in devices not traditionally "electronic". A second trend towards greater portability of appliances (that require power management for extending battery life), means that more and more types of devices will have power management features. As devices become networked, interdependent, and smarter, the number of factors affecting power management will only increase, so that controls will likely become more complex and unwieldy. Controls that are highly configurable—adaptive to user behavior, or informed by daily or weekly calendars—also raise the specter of overcomplexity. Delaying the development of standard power management user interfaces will make it even more difficult to gain convergence in the future. We still have the opportunity to develop and standardize user-friendly interfaces.

We conservatively estimate the statewide savings from this project at $10 million per year for California and over $100 million per year for the nation as a whole. This project responds to all requirements of the RFP, and addresses a topic explicitly cited in the commercial end-use energy efficiency focus (Issue and Goal #4). The project budget is a one-time expenditure of $449,841, while the benefits will accrue *every* year for the foreseeable future,. While the direct costs of the project are all included in the PIER budget request for this project, the U.S. Department of Energy and U.S. Environmental Protection Agency have, through the ENERGY STAR program, committed their institutional resources to ensuring the active participation of industry. These in-kind contributions are invaluable. California is the logical place to pursue this project because such a large portion of the electronics industry is based within the state.

The project is divided into three tasks. The first is to gather and analyze all background data relevant to the project. This will include existing interface implementations in office equipment; a survey of the relevant user interface literature; structured interviews with typical office workers as well as interface designers; and a review of the potentially relevant standards organizations. A thorough summary and discussion will be presented as part of the Task 1 Final Report. The second task is to develop the proposed power management interface guidelines and standards, based on the background research. A rationale for the proposed standard will also be produced, to ensure credibility for the result and to help forge a consensus around it. The third task will subject the proposed standard to critical review from the broad community of interface designers and ordinary users, to identify any shortcomings and modify the standard as needed. The task will also include shepherding the proposal through appropriate national and international standards processes. At all stages in the process, we will closely consult with industry to ensure that we gain the maximum benefit from their considerable experience in user interface design.

This project will advance the technology of user interface design and also develop a "social technology" of widely recognized control elements and heuristics. Technical challenges include identifying interface elements that people find the clearest and simplest, and a system which meets the needs of all manufacturers. The results of this project will be readily measurable through audits of power management configuration and night-time observations of equipment power status. In fact, one of the goals of this project is to enable making such measurements easier and more reliable. We expect significantly higher enabling and functioning rates than we observe today.

This project faces no significant barriers to its success. User interface standards have been instituted in other areas, and other types of standards have been introduced in energy. Without this project, such standardization will be slow if it occurs at all. LBNL's reputation in the field of energy use in office equipment and in energy standards development is unmatched. LBNL has a long track record of delivering quality work, on time, within budget, and advancing science. Our contacts with industry as well as the institutional support of the EPA and DOE mean that we should face no difficulty in gaining the active participation of industry for this project. In addition, success of this *voluntary* approach diminishes the need for any mandatory effort to increase power management savings.

While the focus of this project is office equipment, the principles and standards will apply to many other types of devices in businesses and residences, resulting in additional energy savings and more satisfied consumers. In addition, success in power management controls standardization may stimulate a follow-on effort for residential energy controls (e.g. home lighting and HVAC systems) and for non-energy controls such as imaging (printing and copying), and water use. Power management in office equipment is a logical first effort in this larger domain.